

CLAIMS

What is claimed is:

1. A remote operation support system comprising:
  - a first control system disposed in an operating room;
  - a second control system disposed in a primary support room; and
  - a third control system disposed in at least one secondary support room, the first to third control systems being connected to each other through communication lines, wherein
    - the first control system comprises:
      - an imaging device for imaging a portion to be treated of a patient under operation to obtain an image signal;
      - a first transmission/reception device for transmitting the image signal supplied from the imaging device to the second control system, simultaneously transmitting patient information regarding the patient under operation to the third control system, and receiving support information from the second control system; and
      - a reproduction device for displaying the image signal and reproducing the support information,
    - the third control system comprises:
      - a patient-information processing device for processing the patient information transmitted from the first control system to obtain the result of the processing; and

a second transmission/reception device for receiving the patient information from the first transmission/reception device of the first control system and transmitting information indicating the processing result, obtained by the patient-information processing device, as secondary support information to the second control system, and

the second control system comprises:

an integration device for generating primary support information, used to support an operator in the operating room upon operating, on the basis of the secondary support information transmitted from the third control system and the image signal transmitted from the first control system; and

a third transmission/reception device for receiving the image signal sent from the first control system and the secondary support information sent from the third control system, and transmitting the primary support information generated through the integration device to the first control system.

2. The system according to Claim 1, wherein the first and second control systems and the second and third control systems are connected to each other through the respective communication lines capable of realizing two-way communication, and the first and third control systems are

connected to each other through the communication line capable of realizing one-way communication from the first control system to the third control system.

3. The system according to Claim 1, wherein the first and second control systems, the first and third control systems, and the second and third control systems are connected to each other through the respective communication lines capable of realizing two-way communication.

4. The system according to Claim 1, wherein when there are a plurality of third control systems, the integration device of the second control system generates the integrated information on the basis of a plurality of secondary support information items obtained through the respective third control systems and the image signal sent from the first control system, and transmits the generated information to the first control system.

5. The system according to Claim 3, wherein the first transmission/reception device of the first control system is connected to the second and third transmission/reception devices through a switch for switching between the second and third control systems.

6. The system according to Claim 1, wherein the imaging device includes an endoscopic imaging device having an imaging optical system and an imaging element to image a body cavity, and

the first control system further comprises:  
an image processing unit for converting the image  
signal, obtained by photoelectric conversion through the  
imaging element of the endoscopic imaging device, into a  
video signal; and

a first display for displaying an endoscopic image  
based on the video signal converted and generated through  
the image processing unit.

7. The system according to Claim 6, wherein

the first control system further comprises:  
a visual-field control unit for controlling an imaging  
area or the viewing direction of the endoscopic imaging  
device; and

a first control unit for controlling at least the  
visual-field control unit,

at least one of the second and third control systems  
further includes:

a second control unit for generating an instruction  
signal to control the visual-field control unit to the first  
control unit, and

the instruction signal generated through the second  
control unit is transmitted to the first control unit to  
control the imaging area or the viewing direction of the  
endoscopic imaging device.

8. A remote operation support method using a system

including a first control system disposed in an operating room, a second control system disposed in a primary support room, and a third control system disposed in at least one secondary support room, the first to third control systems being connected to each other through communication lines, the method comprising:

    a patient-information obtaining step of obtaining patient information through the first control system;

    a first transmitting step of transmitting, by the first control system, the patient information obtained in the patient-information obtaining step to the third control system;

    a first receiving step of receiving, by the third control system, the patient information transmitted in the first transmitting step;

    a second transmitting step of transmitting secondary support information based on the patient information from the third control system to the second control system;

    a second receiving step of receiving, by the second control system, the secondary support information transmitted in the second transmitting step;

    a third transmitting step of transmitting primary support information based on the secondary support information from the second control system to the first control system;

a third receiving step of receiving, by the first control system, the primary support information transmitted in the third transmitting step; and

a reproducing step of reproducing, by the first control system, the primary support information received in the third receiving step as an image or a voice.

9. The method according to Claim 8, wherein the first and second control systems and the second and third control systems are connected to each other through the respective communication lines capable of realizing two-way communication, and the first and third control systems are connected to each other through the communication line capable of realizing one-way communication from the first control system to the third control system.

10. The method according to Claim 8, wherein the first and second control systems, the first and third control systems, and the second and third control systems are connected to each other through the respective communication lines capable of realizing two-way communication.

11. The system according to Claim 8, wherein when there are a plurality of third control systems, an integration device of the second control system generates integrated information on the basis of a plurality of secondary support information items obtained through the respective third control systems and an image signal sent from the first

control system, and transmits the generated information to the first control system.

12. The method according to Claim 10, wherein a first transmission/reception device of the first control system is connected to second and third transmission/reception devices through a switch for switching between the second and third control systems.

13. The method according to Claim 8, wherein the first control system comprises:  
an endoscopic imaging device having an imaging optical system and an imaging element to image a body cavity;  
an image processing unit for converting an image signal, obtained by photoelectric conversion through the imaging element of the endoscopic imaging device, into a video signal; and  
a first display for displaying an endoscopic image based on the video signal converted and generated through the image processing unit.

14. The method according to Claim 13, wherein the first control system further comprises:  
a visual-field control unit for controlling an imaging area or the viewing direction of the endoscopic imaging device; and  
a first control unit for controlling at least the visual-field control unit, and

the method further includes:

a step of controlling the imaging area or the viewing direction of the endoscopic imaging device on the basis of an instruction signal to control the visual-field control unit, the instruction signal being transmitted from at least one of the second and third control systems.

15. A remote operation support method using a system including a first control system disposed in an operating room, a second control system disposed in a primary support room, and a third control system disposed in at least one secondary support room, the first to third control systems being connected to each other through communication lines, the method comprising:

an imaging step of imaging a portion to be treated of a patient under operation in the operating room to obtain an image signal;

a first transmitting step of transmitting the image signal obtained in the imaging step from the first control system to the second control system;

a second transmitting step of transmitting patient information regarding the patient under operation from the first control system to the third control system;

a first receiving step of receiving, by the first control system, support information from the second control system;

a reproducing step of displaying, by the first control system, the image signal and reproducing, thereby, the support information to support an operator;

a second receiving step of receiving, by the third control system, the patient information transmitted from the first control system;

a patient-information processing step of processing, by the third control system, the patient information transmitted from the first control system to obtain the result of the processing;

a third transmitting step of transmitting the processing result, obtained in the patient-information processing step, as secondary support information from the third control system to the second control system;

a third receiving step of receiving, by the second control system, the image signal sent from the first control system and the secondary support information sent from the third control system;

an integrating step of generating, by the second control system, primary support information, used to support the operator in the operating room upon operating, on the basis of the secondary support information sent from the third control system and the image signal sent from the first control system; and

a fourth transmitting step of transmitting the primary

support information, generated in the integrating step, from the second control system to the first control system.

16. The method according to Claim 15, wherein the first and second control systems and the second and third control systems are connected to each other through the respective communication lines capable of realizing two-way communication, and the first and third control systems are connected to each other through the communication line capable of realizing one-way communication from the first control system to the third control system.

17. The method according to Claim 15, wherein the first and second control systems, the first and third control systems, and the second and third control systems are connected to each other through the respective communication lines capable of realizing two-way communication.

18. The method according to Claim 15, wherein when there are a plurality of third control systems, an integration device of the second control system generates integrated information on the basis of a plurality of secondary support information items obtained through the respective third control systems and an image signal sent from the first control system, and transmits the generated information to the first control system.

19. The method according to Claim 15, wherein the first control system comprises:

an endoscopic imaging device having an imaging optical system and an imaging element to image a body cavity;

an image processing unit for converting an image signal, obtained by photoelectric conversion through the imaging element of the endoscopic imaging device, into a video signal; and

a first display for displaying an endoscopic image based on the video signal converted and generated through the image processing unit.

20. The method according to Claim 19, wherein

the first control system further comprises:

a visual-field control unit for controlling an imaging area or the viewing direction of the endoscopic imaging device; and

a first control unit for controlling at least the visual-field control unit, and

the method further includes:

a step of controlling the imaging area or the viewing direction of the endoscopic imaging device on the basis of an instruction signal to control the visual-field control unit, the instruction signal being transmitted from at least one of the second and third control systems.